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A STUDY OF INVENTORY MANAGEMENT AT MANUFACTURING INDUSTRIES IN RURAL INDIA

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ABSTRACT

Inventory Management is a widely misinterpreted technique that is not receiving the due attention it deserves. It can be crucial to an industry's production operations especially to small-scale manufacturing plants where even a minimum savings value results in an increased profit margin. The purpose of this study was to evaluate the present-day procurement behaviours and contrast it with mathematically concluded options thereby formulating an entire Inventory model around it. The research was conducted by visiting two industries, namely Rainbow Industries and Karnataka Closures and collecting relevant data. It was found that both industries followed a JIT model of procuring raw material. Further analysis of said data suggested that by implementing an Economic Order Quantity (EOQ) model, both industries could procure an increased quantity of raw material while saving a substantial amount of capital in procurement charges. This would also increase production rates. The analysis techniques utilized where EOQ and ABC Classification of Finished Goods. Additionally, the scope of the study extends to any management or executive personnel looking to reinvent and optimize production capacities using effective tools.

KEYWORDS: Inventory Management, Inventory Control, Production & Economic Order Quantity

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Original Article

INTRODUCTION

In these times, when the economy is very tentative companies will look for various methods to stay ahead of their competition through an effective sales formula and tactical cost reduction methods. In such an environment, especially small-scale industries cannot survive in the market without having a reliable inventory control model incorporated into production operations (William, 1990; Blackstone et al.,1985; Lin, 1980; Dollar, 1980, Silver et al, 1985).

There are many businesses where inventory management plays a very important role. The companies would like to achieve optimal investment in inventories by developing policies that achieves these objectives. This will lead to maximising the rate of return and minimising the liquidity and business risk. In other words, minimising the inventory will lower the cost and thereby improving the profitability.

Economic Order Quantity (EOQ) model of inventory management is used to obtain the size of the optimum quantity to deliver and then selecting the supplier who will deliver the quantity at the lowest rate. This will ensure minimise the cost of total investments in inventories. Whenever inventory of an item is below the limit specified, EOQ model is used to determine the optimal amount of inventory to order (Chambers et al, 2011).

Even in health care related industries, inventory management of various drugs plays an important role in improving patient care as well as use of resources optimally (Ceylan, et al, 2017; Singh et al, 2015).

LITERATURE REVIEW

In inventory management one needs to obtain the balance between inventory keeping costs and inventory holding benefits. As we know that having an inventory will ensure the availability of goods at all times. Inventory management looks to improve the net benefits and looks to improve overall supplier cooperation on supply chain improvement (Shen et al, 2016).

When very high levels of inventory are maintained, it will increase storage cost, spoilage, insurance and interest on funds borrowed to finance inventory. There are many benefits of maintaining low inventory, but managers should also look in to serval other parameters like sales, liquidity, production, finance available for inventory, reliability of the supplier, order delay and seasonality. If increased level of inventory is maintained, it will serve well during production slowdowns by lowering the prospects of lost sales from stockouts. The level of inventory will also be affected by varying interests in the short term. In other words, an increase in these rates would lead to a reduction in the optimum level of holding inventory (Shim et al, 2008).

Financial managers are responsible for increasing the capital needed to carry inventory and to maintain financial health of the company. The main objective of maintaining the inventories has to be to sustain the operations by controlling the cost of holding, ordering and carrying inventories (Brigham et al, 2005; Hassin, 1991).

The stock out problems faced by the industry due to ineffective forecasting methods were also reported (Gonzales et al, 2010). As a result, it incurred heavy losses in sales as well as profit. In this paper, he reports various recommendations given to avoid losses and to prevent back ordering and material stock-outs. This involves using an inventory model in place of existing forecasting model incorporating economic order quantity and reorder point obtained by computation.

This paper reports a study conducted to observe, analyse and apply the concepts of inventory management concepts at industries in and around Manipal. In the analysis of the data obtained, economic ordered quantity and ABC analysis were used.

In ABC Classification four different layered final products of nine different sizes and five different colours were chosen from the Rainbow Industries which are fast moving items. Rigorous data collection was carried for nearly six months and behaviour of sales due to the demand for those items was studied. ABC Analysis is an inventory categorization technique, where each product is divided into different categories such as A, B, and C. Inventory, stock levels are arranged according to the analysis done.

METHODOLOGY

All the products manufactured by the two industries were chosen for the study. At Rainbow Industries, eight different products of water tanks with four different types and five different colours which were considered as high revenue generating products were selected. Similarly, at Karnataka Closures, Caps of four varying sizes of products were chosen.

A large amount of relevant data pertaining to cost of ordering, purchase and units were collected. This data was used in the computation economic order quantity, reorder point and total annual cost of each product.

Quantitative techniques of management have been used in the study while analysing various data pertaining to managing inventory. Various factors influencing the efficiency and effectiveness of the inventory system were considered.

They included cost, service and competitive advantage.

The various modes through which data collected included collecting information from the supervisors at the warehouse and purchase department of the company, referring company records such as schedules prepared for production, inventory and production files.

RESULT AND ANALYSIS

Inventory Control of Rainbow Industries

Inventory Control of Rainbow Industries Pvt. manufactures and markets a wide range of RPVC pipes and other products for a host of applications such as potable cold water, sewage, drainage, waste water, and irrigation. It is situated in Manipal, Karnataka at Shivalli Industrial Area. This study was carried out in the newly developed water-storage tank division where the two raw materials used are linear low-density polyethylene (LLDPE) granules and colour powder with UV pigment. LLDPE raw material is purchased from Mangalore while colour powder is purchased from Ahmadabad. The final products of water-storage tanks are two layer, three layer and four layer water-storage tank. They are available in 200lt, 300lt, 500lt, 750lt, 1000lt, 1500lt, 2000lt, & 3000lt capacities and in colours ranging from white to green-blue as shown in figure 1.

Figure 1: Two, Three and Four Layer Water Storage Tank of Different Capacities

The current raw-material procurement behaviour of the industry is shown in table1 that 17,000kgs of LLDPE, which are ordered 12 times in a year, are used to produce 715 units per month. However, the EOQ model analysed in this project shows that 23,000kgs of LLDPE ordered nine times a year is the optimum value to reduce both ordering and holding costs as in table 1

Table 1: Economics of Present and Proposed Inventory Systems of Rainbow Industries

Water Storage Tanks		
LLDPE (Linear Low density Polyethylene) Granules	**Present System**	**Proposed System**
Order Quantity(kg)Q	17000	23000
Water tanks produced per month	715	967
Number of Orders	12	9
Average Inventory Level	NA	11, 633.2 kg
Total annual ordering cost (Rs.)	24000	18000
Total annual carrying cost	0.015*NA*100	□ 17,450
Total cost	NA	□ 35, 450

Due to the industry not maintaining an Inventory System, Average Inventory Level could not be considerably

quantified. As a result, the exact Total Cost of the Present Inventory System could not be computed. However, it can be estimated that the Proposed System does in fact result in a savings amount owing to the considerable decrease in Procurement/Ordering Cost.

ABC Classification of Water Storage Tanks

After carrying out an ABC Analysis on the six months of recorded sales-data, it was concluded that among 2 layer, 3 layer and 4 layer water tanks, 200 litre to 3000 litre tanks as shown in figure 1, 2 and 3 were classified as A, B and C according value and itemise in percent as shown in table 2, 3 and 4.

Table 2: ABC Classification based on Inventory Value and Number of Item in Percentage

Two (2) Layer Water Tank			
Class	**Capacity of Water Tanks in Litres**	**Percentage of Total Value**	**Percentage of Total Items**
A	1500 -3000	70	10
B	750-1000	19	35
C	200-500	11	55

Table 3: ABC Classification based on Inventory Value and Number of Item in Percentage

Three (3) Layer Water Tank			
Class	**Capacity of Water Tanks in Litres**	**Percentage of Total Value**	**Percentage of Total Item**
A	2000-3000	57	47
B	1000-1500	29	41
C	500-750	14	12

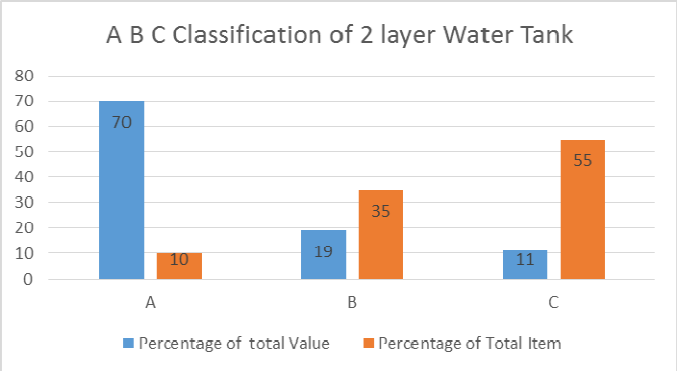

Figure 2: ABC Classification for Two-Layer Water Tank

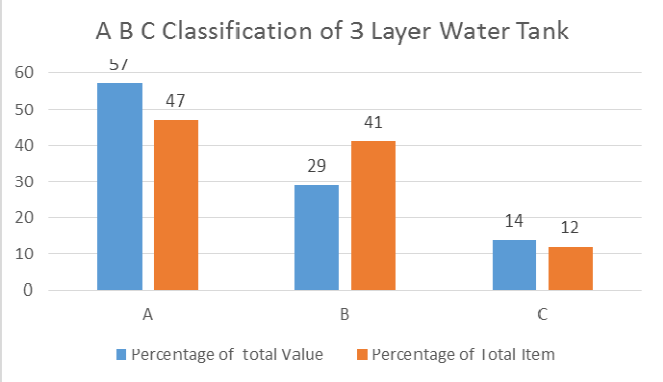

Figure 3: ABC Classification for 3 layer water tank

Table 4: ABC Classification based on Inventory Value and Number of Item in Percentage

Four (4) Layer Water Tank			
Class	**Capacity of Water Tanks in Litres**	**Percentage of total Value**	**Percentage of Total Item**
A	1500-2000	61	17
B	750-1000	30	62
C	500	9	21

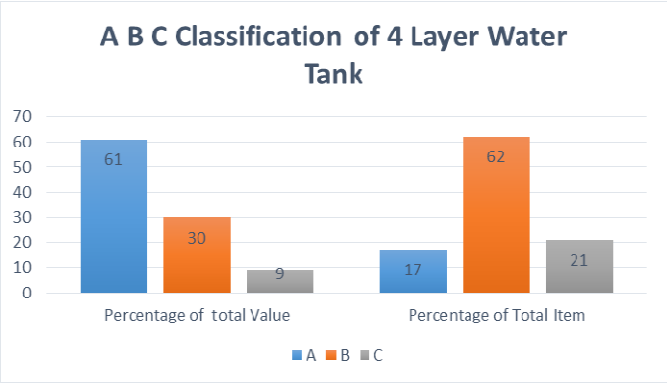

Figure 4: ABC Classification for 4 Layer Water Tank

ABC analysis was carried on managing the inventory required for the production of two-layer water tanks. It has been observed that there are 10% of the items come under A category which in turn represents almost 70% of the value. On the other hand, 35% of the items fall under B category, which represents about 19% of the value. Similarly, there 55% items coming under the C category which represents 11% of the value as shown in table 3. Studies were also carried out on subsequent layer tanks for three layered and four layered tanks as shown in figure 3 and 4.

Inventory Control of Karnataka Closures

Karnataka Closures Pvt. Ltd. manufacturers and exports Aluminium Pilfer Proof (P.P.) Caps. Located in Shivalli Industrial Area of Manipal, Karnataka and was established in 1998. It has a production capacity of 4.5 lakh P.P. Caps per day. The industry boasts of sophisticated equipment capable of manufacturing different sizes of P.P Caps. It caters to Food, Beverage & Pharmaceuticals industries. The Raw Materials used are high quality printed Aluminium sheets with a 0.17 – 2.0 thickness obtained from suppliers in Bombay or Bangalore. The following product sizes manufactured are 25mm, 28 mm, 29.35 mm and 25/29 mm as shown in figure 5 and 6.

Table 5: Monthly Usage of Raw Materials Per Cap

Cap Size (mm)	**Aluminium Per Sheet Weight**	**No of Caps**	**Aluminium Sheets Kg / Month**	**Caps Produced Average Qty / Month**
25	0.280 Kg	250	2,588	2310802
28	0.290 kg	180	951	590500
29.35	0.300 Kg	110	1,361	504160
25/29	0.310 Kg	156	285	150396
Total			**5,185 kg**	**35, 55, 858**

Figure 5: P.P Caps of Varying Sizes by Karnataka Closures

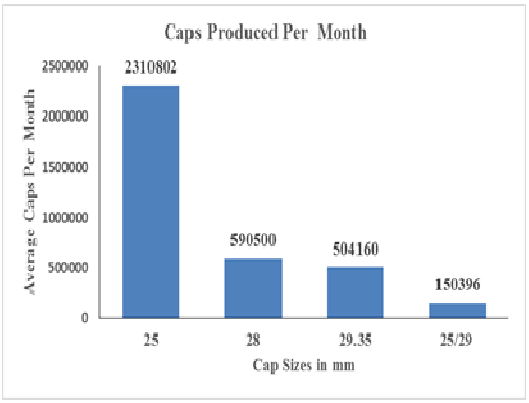

Figure 6: Caps of Different Size Produced Per Month

Economic order Quantity (EOQ)

The current raw-material procurement behaviour of the industry shows (based on an analysis of six- months of sales records, as shown in table 5.0) that 5,185kgs of Aluminium sheets, which have ordered 12 times in a year, are used to produce 35,55,858 P.P Caps per month. However, the EOQ model analysed in this project shows that 15,200kgs of Aluminium sheets ordered 6 times a year, is the optimum value to reduce both ordering and holding cost as shown in table 6.

Table 6: Economics of Present and Proposed Inventory Systems

Cap Industry		
	Present System	**Proposed System**
Order Quantity(Kg)(EOQ) Q	5000	15200
Number of Orders	12	6
Average Inventory Level	NA	7,900 kg
Total annual ordering cost (Rs.)	45000	22500
Total annual carrying cost	0.015*NA*200	□ 23,700
Total cost	NA	□ 46,200

ABC Analysis

After carrying out an ABC Analysis on the six months of recorded sales-data, it was concluded that among the four sizes of Caps manufactured, Present method, 28mm Caps as shown in table 7 were ranked A with a 51.58% (by Value), 13.86% (by Items) respectively, 29-35 mm Caps were ranked B with a 26.58% (by Value) 17.51% (by Items) and 25mm Caps were ranked C with a 21.82% (by value), 68.61% (by Items) as shown in table 7 and figure 7.

Table 7: ABC Classification of Caps on Percentage of Inventory Value and By Item Present Method

Cap sizes	Cumulative Qty	Cost per Unit	Percentage of Value	Percentage of Item	Class of items
28 mm	4,65,336	0.78	51.58	13.86	A
29 -35 mm	5,87,666	0.402	26.58	17.51	B
25 mm	23,02,494	0.33	21.82	68.61	C

Table 8: ABC Classification of Caps on Percentage of Inventory Value and by Item Proposed Method

Cap Sizes	Cumulative Qty	Cost per Unit	Total Cost/Cap Size	Percentage of Value	Percentage of Item	Class of Items
28 mm	3,20,000	0.78	249600	51.58	9.63	A
29-35 mm	7,00,000	0.402	281400	26.58	21.06	B
25 mm	23,02,494	0.33	759823.02	21.82	69.3	C

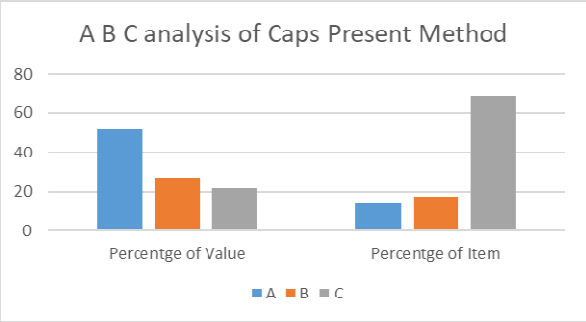

Figure 7: ABC Analysis of Caps in Percentage Present Method

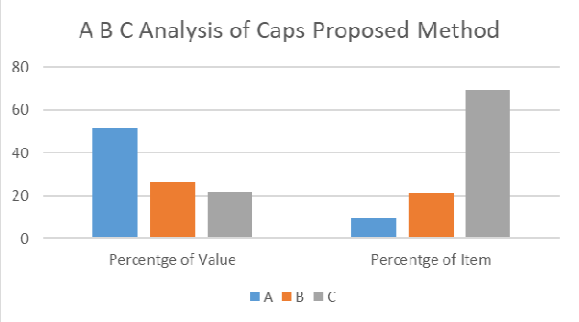

Figure 8: ABC Analysis of Caps in Percentage Proposed Method

Proposed method, 28mm Caps as shown in table 8 and figure 8 were ranked A with a 51.58% (by Value), 9.63% (by Items) respectively, 29-35 mm Caps were ranked B with a 26.58% (by Value) 21.06% (by Items) and 25mm Caps were ranked C with a 21.82% (by value), 69.3% (by Items). Due to the industry not maintaining an Inventory System, Average Inventory Level could not be considerably quantified. As a result, the exact Total Cost of the Present Inventory System could not be computed. However, it can be estimated that the Proposed System does in fact result in a savings amount owing to the considerable decrease in Procurement/Ordering Cost.

CONCLUSIONS

- The main conclusions derived from the study are given below.
- Replacing current inventory management system with continuous lyre viewing policy.
- If there is a minimum order quantity, water tanks manufacturing company and caps manufacturing company are allowed to adjust optimal order quantity result obtained from EOQ calculation. This is because in the economic order quantity, the total cost incurred in the supply chain is relatively stable.
- In order to increase productivity and efficiency in both the industries, they should ensure record accuracy in their inventory controlling process, because by having a high accurate inventory record, a company can get many positive impacts such as higher customer service level, lower cost, and higher productivity.
- The ABC classification was based on value and inventory value. This analysis has been used to highlight the strict management control required in both water tank and cap manufacturing firms in the appropriate utilisation of funds and out-of-stock situations in both. The research has demonstrated that careful and controlled inventory management of an industry results in a highly organised system of procuring material to meet demand scenario. Usage of economic ordering of items, optimised production rates, effective storage planning and prioritised final products would result in drastic improvements in the profit margin of the company.

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